Anatomy and Physiology: Course Study Guide

Introduction to the Structural Units

Anatomy and Physiology:

- Divided into many branches based on the investigative techniques used, the type of knowledge desired, or the parts of the body under study.
    - **Gross Anatomy**
        - The study of large and easily observable structures on an organism.
        - It is done through dissection and visible inspection with the naked eye.
        - The different body parts and regions are studied with regard to their general shape, external features, and main divisions.
    - **Microscopic Anatomy**
        - Refers to the use of microscopes to enable one to see the minute details of organ parts.
        - Ultra wave and electron microscopes provide greater magnification and resolution than optical microscopes.
        - Subdivided into two different regions:
            - **Cytology**
                - The study of the structure, function, and development of cells that comprise the different body parts.
            - **Histology**
                - Studies the tissues and organs that make up the entire body of an organism.
    - **Developmental Anatomy**
        - Studies the growth and development of an organism during its lifetime.
            - In more specific terms, embryology
                - Studies the formation of an organism from fertilized egg to birth
    - **Comparative Anatomy**

        - The different body parts and organs of humans can be studied with regard to similarities with and differences from others in the animal kingdom.
    - **Systematic Anatomy**
        - The study of the structure of various organs or parts that comprise a particular organ system.
        - Specific terms in this area:
            - **Dermatology**
                - Study of the integumentary system(skin, hair, and nails).
            - **Endocrinology**
                - Study of the endocrine or hormonal system.
            - **Neurology**
                - Study of the nervous system.

Anatomical Terminology:

- In the study of anatomy and physiology, special words are used to describe the specific location of a structure, organ, or the relative position/direction of one body part to another
    - **Anatomical position**
        - A human being is standing erect, with face forward, arms at the side, and palms forward.
    - **Anterior or ventral**
        - Means “front” or “in front of”
        - Examples:
            - The knees are located on the anterior surface of the human body.
            - A ventral hernia may protrude from the front or belly of the abdomen.
    - **Posterior or dorsal**
        - Means “back” or “in back of”
        - Examples:
            - Human shoulder blades are found on the posterior surface of the body.
    - **Cephalic and caudal**

        - Cephalic means “skull” or “head end” of the body.
        - Caudal means “tail end”
    - **Superior**
        - Means “upper” or “above another”
    - **Inferior**
        - Means “lower” or “below another”
    - **Medial**
        - “Toward the midline or median plane of the body”
    - **Lateral**
        - “Away” or “toward the side of the body”
    - **Proximal**
        - “Towards the point of attachment to the body” or “toward the trunk of the body”
    - **Distal**
        - “Away from the point of attachment or origin” or “farthest from the trunk”
    - **Superficial or external**
        - “On or near the surface of the body”
    - **Deep or internal**
        - Involves damage to an internal organ.
- **Terms referring to Body Planes and Sections**
    - **Planes**
        - Imaginary anatomical dividing lines that are useful for separating body structures.
    - **Section**
        - A cut made in a certain direction of a certain plane.
    - **Sagittal plane**
        - Divides the body into left and right parts.
    - **Midsagittal plane**
        - The plane starts in the middle of the skull, proceeds down, bisects the sternum and vertebral column, the body would be divided *equally* into right and left halves.

    - **Coronal (frontal) plane**
        - A vertical cut at right angles to the sagittal plane, dividing the body into anterior and posterior portions.
    - **Transverse (cross section)**
        - A horizontal cut that divides the body into upper and lower portions.
- **Terms Referring to Cavities of the Body:**
    - **Dorsal cavity**
        - Posterior cavity of the body that houses the brain and spinal column.
    - **Cranial cavity**
        - Area of the body containing the brain.
    - **Spinal cavity**
        - Area of the body containing the spinal cord.
    - **Thoracic cavity**
        - Area of the body divided into 2 cavities: the left pleural cavity contains the left lung and the right pleural cavity contains the right lung.
    - **Abdominopelvic cavity**
        - Area below the diaphragm, with no separation between the abdomen and pelvis.
    - **Abdominal cavity**
        - Area of the body that contains the stomach, liver, gallbladder, pancreas, spleen, small intestine, appendix, and part of the large intestine.
    - **Pelvic cavity**
        - Area of the body containing the urinary bladder, reproductive organs, rectum, remainder of large intestine, and appendix.
- **Terms Referring to Regions in the Abdominopelvic Cavity:**
    - **Epigastric**
        - Upper region of the abdominal cavity, located just below the sternum.
    - **Umbilical**
        - Area located around the navel (umbilicus); the right and left lumbar region.
    - **Hypogastric**

        - Lower region of the abdominal area.
- **Smaller Cavities:**
    - **Orbital cavity**
        - Contains the eye and its external structures.
    - **Nasal cavity**
        - One of the pairs of cavities between the anterior nares and the nasopharynx.
    - **Oral (buccal) cavity**
        - Encloses the teeth and tongue.
- **Human Development:**
    - **Cells**
        - The basic unit of structure and function of all living things.
    - **Tissues**
        - Special cells grouped according to function, shape, size, and structure.
    - **Organs**
        - Tissues, in turn, form larger functional and structural units.
    - **Organ system**
        - Organs that are grouped together because more than one is needed to perform a function.

Chemistry of Living Things

Chemistry:

- The study of the structure of matter and composition of substances, their properties, and their chemical reactions.
    - **Biochemistry**
        - The study of the chemical reactions of living things.
- **Matter and Energy:**
    - **Matter**
        - Anything that has weight (mass) and occupies space.
        - Exists in solid, liquid, and gas forms.
    - **Energy**
        - The ability to do work or to put matter into motion.
        - Exists in our bodies
            - **Potential energy**
                - Stored in cells waiting to be released.
                - Ex. laying in bed.
            - **Kinetic energy**
                - Work resulting in motion.
                - Ex. getting out of bed.
    - **Atoms**
        - The smallest piece of an element.
        - Invisible to the human eye.
        - The normal atoms are made up of **subatomic particles**:
            - **Protons**
                - Has a positive electrical charge.
            - **Neutrons**
                - Have no electrical charge.
            - **Electrons**
                - Has a negative charge.
        - **Isotopes**

                - Have the same number of protons but a different number of neutrons.
                - Radioactive
                    - Some isotopes are unstable and decay.
    - **Elements**
        - Substances that can neither be created nor destroyed by ordinary chemical means.
    - **Compounds**
        - Elements combined in definite proportion by weight to form a new substance.
        - Unicellular
            - One-celled microbe
        - Multicellular
            - Many-celled animal or plants
        - Organic compounds
            - Compounds that contain the element carbon
    - **Molecules**
        - The smallest unit of a compound that still has the properties of the compound and the ability to lead its own stable and independent existence.
    - **Chemical bonds**
        - Bonds formed when atoms share or combine their electrons with atoms of other elements.
        - **Ionic bond**
            - Bond in which one atom gives up an electron to another atom.
        - **Covalent bond**
            - Atoms share electrons to fill their outermost levels/shells.
        - **Hydrogen bond**
            - Bond that holds water molecules by forming a bridge between the negative oxygen atom of one water molecule and the positive hydrogen atom of another molecule.
- **Types of Compounds:**

- **Inorganic**
  - Made of molecules that do not contain the element carbon (C).
- **Organic**
  - Always contain the element carbon, combined with hydrogen and other elements.
- **Carbohydrates**
  - Compounds of the elements carbon, hydrogen, and oxygen.
  - Have twice as many hydrogen atoms as oxygen and carbon.
  - **Divided into 3 groups:**
    - Monosaccharides
      - Sugars that cannot be broken down further.
      - Also called single or simple sugars.
      - Ex. glucose, fructose, galactose…
    - **Disaccharides**
      - Known as a double sugars because it is formed from 2 monosaccharide molecules by a chemical reaction called **dehydration synthesis.**
    - **Polysaccharides**
      - Large, complex molecules of hundreds to thousands of monosaccharides bonded together in one long, chain-like molecule.
      - Ex. starch, cellulose, glycogen
- **Lipids**
  - Molecules containing the elements carbon, hydrogen, and oxygen.
  - Different from carbohydrates because they have much less oxygen in relation to hydrogen
  - Ex. fats, phospholipids, and steroids.
    - **Fats (triglycerides)**
      - Consists of glycerol and fatty acids and make up 95% of fats in the human body.
    - **Phospholipids**

        - Contain carbon, hydrogen, oxygen, and phosphorus.
        - This type of lipid may be found in the cell membranes, the brain and nervous tissue.
    - **Steroids**
        - Lipids that contain **cholesterol**.
            - Cholesterol is essential in the structure of the semipermeable membrane of the cell.
- **Proteins**
    - Organic compounds containing the elements carbon, hydrogen, oxygen, nitrogen, and normally phosphorus and sulfur.
    - Found in every part of a living cell.
    - **Amino acids**
        - Small molecular units that work together to build proteins in the body.
    - **Enzymes**
        - Specialized protein molecules found in all living things.
        - They help control the various chemical reactions occurring in a cell, so each reaction occurs just at the right moment and time.
- **Nucleic acids**
    - Important organic compounds containing the elements carbon, oxygen, hydrogen, nitrogen, and phosphorus.
    - There are 2 groups of **nitrogenous bases**
        - **Pyrimidines**
            - Either cytosine or thymine
        - **Purines**
            - Either adenine or guanine

Cells

Protoplasm:

- An aqueous solution of carbohydrates, proteins, lipids, nucleic acids, and inorganic salts surrounded by a cell membrane.

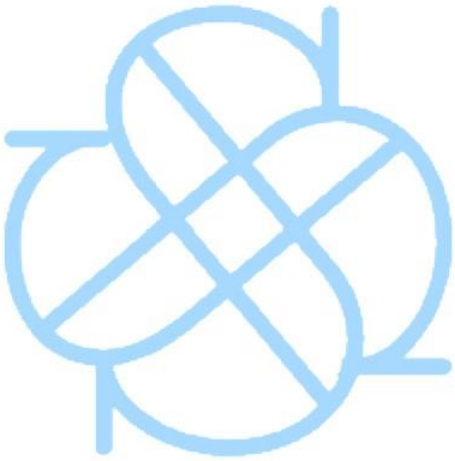
Organelles

- Microscopic structures within the cell having a special function or capacity.
    - **Ribosomes**
        - Submicroscopic particle attached to endoplasmic reticulum; site of protein synthesis in the cytoplasm of the cell.
    - **Centrosomes**
        - Tiny area near the nucleus of an animal cell; it contains two cylindrical structures called centrioles
    - **Endoplasmic reticulum**
        - Transport system of a cell; can be smooth or rough.
    - **Mitochondria**
        - Organelle that supplies energy to the cell.
    - **Lysosomes**
        - Cytoplasmic organelle containing digestive enzymes.
    - **Peroxisomes**
        - Membranous sacs that contain oxidase enzymes.
    - **Golgi apparatus**
        - Membranous network that resembles a stack of pancakes; it stores and packages secretions to be secreted by the cell.
    - **Cytoskeleton**
        - Internal framework of the cell consisting of microtubules, intermediate filaments, and microfilaments.
    - **Nucleoplasm**
        - Protoplasm inside the nucleus of a cell
    - **Cytoplasm**
        - Protoplasm of the cell body, excluding the nucleus.
    - **Chromatin**

        - When a cell reaches a certain size, it divides to form two new cells. The DNA and protein are arranged in a loose and diffuse state.
    - **Chromosomes**
        - Nuclear material that determines hereditary characteristics.
    - **Cilia**
        - Protrusions from the cell membrane that move material across the cell's surface
        - Short hair-like protrusions
    - **Flagella**
        - Protrusions from the cell membrane that allow the cell to move throughout the environment
        - Singular tail like protrusions.
    - **Meiosis**
        - Process of cell division in the sex cells
        - Ovum (from the female) and the spermatozoa (from the male) reduce their chromosomes by half.
        - When fertilization occurs, the two sex cells combine to form a simple cell
            - Zygote
                - Has full set of 46 chromosomes
    - **Mitosis**
        - First stage is the division of the nucleus
        - Second stage is the division of the cytoplasm
        - Orderly series of steps in which the DNA in the nucleus of the cell is equally distributed into 2 daughter cells or identical nuclei
        - Phases
            - **Interphase**
                - The cell goes through all metabolic cellular activities to help in the maintenance of homeostasis.
                - Known as the resting stage.
            - **Prophase**

        - The two pairs of centrioles start to separate toward the opposite ends of the cell.
        - An array of cytoplasmic microtubules form between them.
        - The nucleus disappears
    - **Metaphase**
        - Nuclear membrane has dissolved completely.
        - Chromatid pairs arranged in a single file.
        - One chromatid pair per spindle fiber between the two centrioles.
    - **Anaphase**
        - The chromatid pairs separate and are pulled apart by the shortening spindle fibers toward the centrioles.
        - The two chromatids of each replicated chromosome are now fully separated
    - **Telophase**
        - The chromosomes migrate to the opposite poles of the cell.
        - They start to uncoil
        - The nuclear membrane and and the nucleus reappear
        - When cytoplasmic division is finished, two new daughter cells are formed.
- **Cell death**
    - **Necrosis**
        - Name given to *unprogrammed* death of cells and living tissue.
        - There are many causes of necrosis
            - Injury, infection, cancer, infarction, toxins, and inflammation.
    - **Apoptosis**
        - Orderly process by which cells intentionally die.
        - The cell itself initiates, regulates, and executes its death with an elaborate arsenal of cellular and molecular activity.
- **Osmosis**

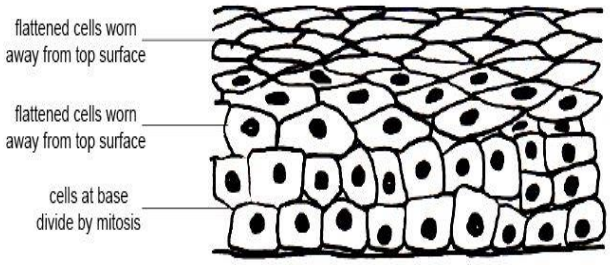
- The diffusion of water or any other solvent molecule through a selectively permeable membrane.



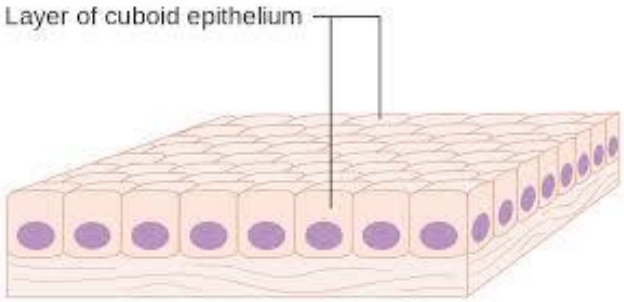
Tissues and Membranes

Tissues

- Tissues
    - **Epithelial Tissue**
        - Cells form a continuous layer covering internal and external body surfaces, provide protection, and produce secretions.
        - **Squamous Epithelial**
            - Flat, irregular shaped cells. They line the heart, blood, and lymphatic vessels.



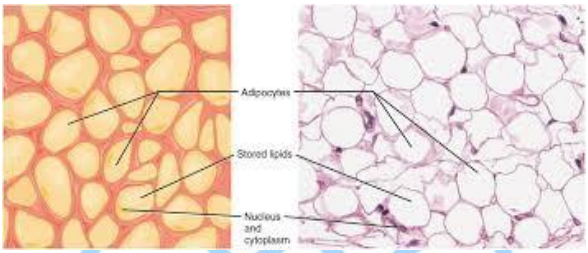
        - **Cuboidal Epithelial**
            - Cube-shaped cells, they line the kidney tubules and cover the ovaries.



        - **Columnar Epithelial**

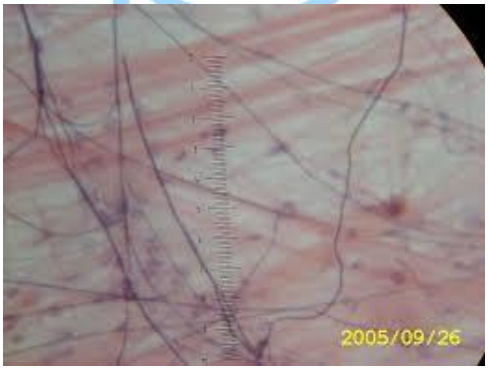
- They are elongated, with the nucleus generally near the bottom and often ciliated on the outer surface. They line the ducts, digestive tract, parts of the respiratory tract, and glands

- **Connective Tissue**
  - **Adipose**



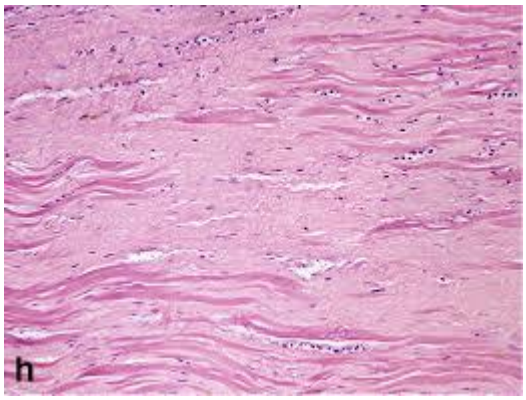
- Stores fat, acts as filler tissue, cushions and supports the body. It is a type of loose connective tissue composed of saclike adipose cells.

  - **Areolar tissue**



- Supports both nerve and blood vessels that transport nutrient materials and waste.

  - **Dense fibrous tissue**

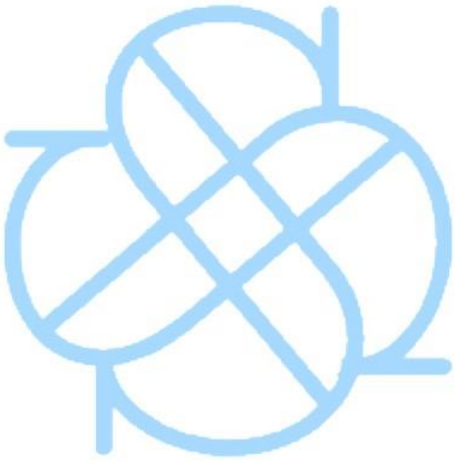


- Made from closely packed white collagen fibers. It is flexible but not elastic. Has poor blood supply and heals extremely slow.

Tissue Repair

- **Primary repair of a clean wound**
  - A clean wound is a cut on the skin where infection is not present
  - The deep layer of stratified squamous divides.
  - New stratified squamous epithelial cells push themselves upward to the surface of the skin.
- **Primary repair over a large skin area**
  - Fluid will escape from the broken capillaries
  - The fluid dries and seals the wound, scab forms
  - The scab prevents pathogens from entering the site
  - Epithelial cells form at the edges of the scab and continue to grow over the damaged area until it gets fully covered
- **Primary repair of deep tissue**
  - The edges of the wound must be sewn together with a suture
  - A tremendous amount of of fluid will leak onto the wound
  - Helps form a coagulation that seals the wound
  - In 24-36 hrs the epithelial cells lining the capillaries and fibroblasts of connective tissue degenerate rapidly
  - The newly formed cells remain along the edges of the wound.
  - On the 4th-5th day fibroblast cells become very active in making new collagen fibers.

    - Once the tissues come together scar tissue is visible.
- **Secondary repair**
    - A process known as **granulation** occurs in a large open wound with small or large tissue loss
    - The process will form new vertically upstanding blood vessels
    - These new blood vessels are surrounded by young connective tissue and wandering cells of many types
    - Fibroblast will be quite active in the production of new collagen
    - The large wound eventually heals but it takes *a lot* of time



Integumentary System

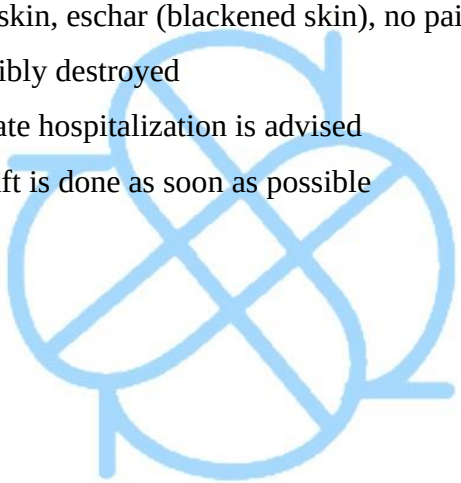
- **Functions of the skin**
    - A **covering** for the underlying tissues, protecting them from dehydration, injury, and germ invasion.
    - Helps **regulate body temperature** by controlling the size of the blood vessels in the dermal layer of the skin.
    - Helps manufacture **vitamin D.** The ultraviolet light on the skin is necessary for the first stages of vitamin D formation.
    - The site for many **nerve endings**
        - A square inch contains 72ft of nerves and hundreds of receptors.
    - Has tissues for the **temporary storage** of fat, glucose, water, and salts. Most of these substances are eventually absorbed by the blood and transported to other parts of the body.
    - Serves to **reduce the harmful radiation** contained in everyday sunlight.
    - Has special properties that allow it to absorb drugs and many other chemical substances.
- **Structure of the skin**
    - **Epidermis**
        - The outermost layer of the skin; made up of epithelial cells, with no blood vessels present whatsoever.
    - **Dermis**
        - Known as “true skin” it is made up of connective tissue and it contains some blood vessels.
    - **Subcutaneous**
        - The fat layer of the skin
- Skin color as **indicator of disease**
    - **Redness**
        - Erythema
            - Causes dilation of capillary network
            - Fever, allergic reaction, and inflammation
    - **Bluish tint (grayish in darker skin tones)**

        - Cyanosis
            - Causes a decrease in oxygen in capillaries
            - Heart or respiratory disease
    - **Yellow**
        - Jaundice
            - accumulation of bile in capillaries
            - Gallbladder or liver disease
    - **Pallor**
        - Constriction of capillaries or decrease in red blood cells
        - Emotional stress or anemia
- **Hair**
    - **Root**
        - The part of the hair that is implanted in the skin
    - **Shaft**
        - The hair that projects from the skin's surface
    - **Hair follicle**
        - The root embedded in an impocketing of the epidermis
    - **Alopecia**
        - A genetic predisposition that causes permanent baldness in some people.
- **Disease conditions and nail color**
    - **Liver disease**
        - White nails
    - **Kidney disease**
        - Half of nail is pink, other half is white
    - **Heart condition**
        - Nail bed is red
    - **Lung disease**
        - Yellow and thickening nails
    - **Anemia**
        - Pale nail bed
    - **Diabetes**

        - Yellowish with a slight blush at the base
    - **Hypoxia**
        - Bluish nails
- **Disorders of the skin**
    - **Acne vulgaris**
        - (acne) is a common non contagious and chronic disorder of the sebaceous glands
    - **Dermatitis**
        - A non contagious inflammation of the skin
    - **Eczema**
        - An acute or chronic non contagious inflammatory skin disease
    - **Impetigo**
        - An acute inflammatory and contagious skin disease seen in babies and young children.
        - Characterized by appearance of vesicles that rupture and develop distinct yellow crust
    - **Psoriasis**
        - A chronic non contagious inflammatory autoimmune skin disease characterized by the development of dry reddish patches covered with silvery-white scales.
    - **Ringworm**
        - A highly contagious fungal infection marked by raised, itchy, circular patches with crusts.
    - **Urticaria (hives)**
        - A non contagious skin condition recognized by the appearance of intensely itching wheals or welts.
    - **Herpes simplex**
        - Occurs around the face and mouth
        - Spreads through oral contact

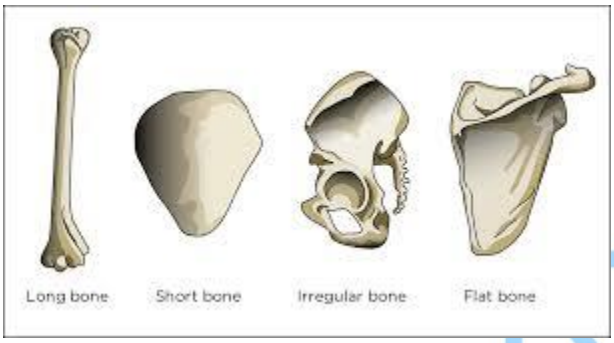
    - **Genital herpes**
        - Another form of the herpes virus
        - May appear as a blister in the genital area
- **Skin cancer**
    - Associated with exposure to ultraviolet light
    - Most common type of cancer in people
    - **Basal cell carcinoma**
        - The most common and least malignant type of skin cancer
        - Usually occurs on the face
        - Full recovery occurs in 99% of the cases
    - **Squamous cell carcinoma**
        - Arises from the epidermis and occurs most often on the scalp and lower lip
        - This type grows rapidly and metastasizes to the lymph nodes
        - Chances for recovery are good only if found early
    - **Malignant melanoma**
        - Occurs in pigmented cells of the skin called melanocytes
        - Metastasizes to other areas quickly
        - A color or size change in a mole or wart may indicate this type
        - The 5 year survival rate is 91%
- **Burns**
    - Traumatic injuries that result from exposure to radiation from the sun, heat lamp, contact with boiling water, steam, fire, chemicals, or even electricity.
    - **Rule of nines**
        - Used to measure the percent of the body burned.
        - The body is divided into 11 areas and each area accounts for 9% of the total body surface.
        - Each arm is 4.5%, perineal area is 1%, each leg is 9%, etc…
    - **First degree (superficial) burns**
        - Involves only the epidermis
        - Sunburns are usually in this category

        - May include swelling, redness, and pain
        - Hold burned area under cool running water for 10-15 min
        - Healing occurs within a week
    - **Second degree (partial-thickness) burn**
        - May involve the epidermis and dermis
        - Include pain, swelling, redness, and blistering
        - Pain medication and dry sterile dressing applied to open skin areas
        - Healing occurs within 2 weeks
    - **Third degree (full-thickness) burn**
        - Involves complete destruction of the epidermis, dermis, and subcutaneous layers.
        - Loss of skin, eschar (blackened skin), no pain because the nerve endings are possibly destroyed
        - Immediate hospitalization is advised
        - Skin graft is done as soon as possible



Skeletal system

- **Functions**
    - Supports body structure and provides shape
    - Protects the soft and delicate organs
    - Allows movement and anchorage of muscles
    - Provides mineral storage
    - The site for homeostasis



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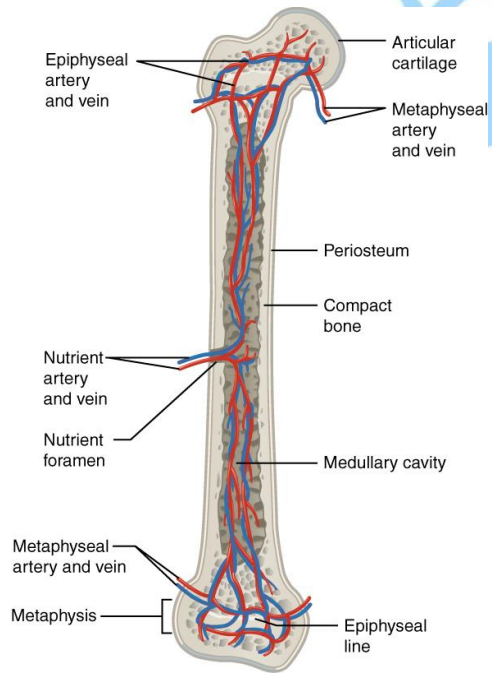

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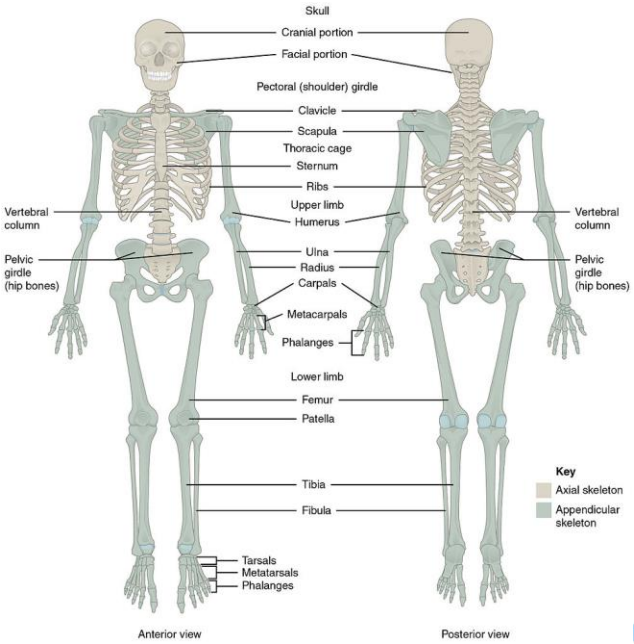

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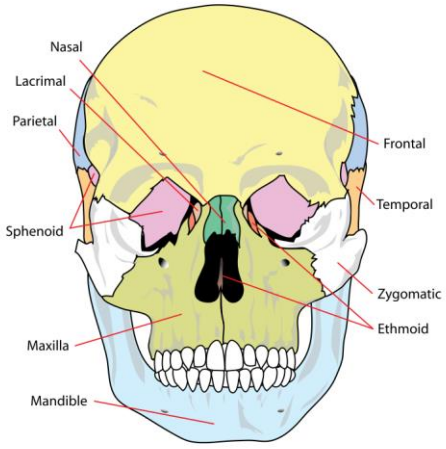
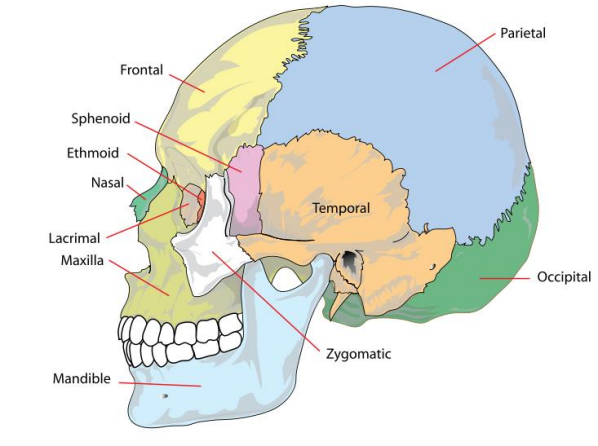


(Villarreal, M. R. (2007, January 4). File:Human skull front simplified (bones).svg. Retrieved July 19, 2020, from https://commons.wikimedia.org/wiki/File:Human_skull_front_simplified_(bones).svg)



(File:Human skull side simplified (bones).svg. (2019, August 29). Retrieved July 19, 2020, from https://en.wikipedia.org/wiki/File: Human_skull_side_simplified_(bones).svg)

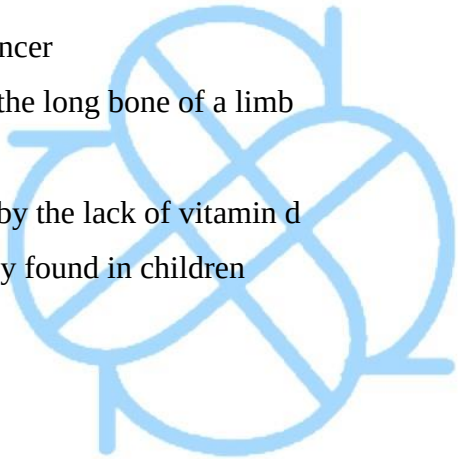
Skeletal system (continued)

****Note: Break and fracture mean the same thing.*

- **Types of fractures**
  - **Closed/Simple**
    - The bone is broken, but the broken ends do not pierce through the skin to form an external wound.
  - **Open/Compound**
    - The most serious type of fracture
    - The broken bone ends pierce through the skin.
    - Site for infection of the bone and neighboring tissues.
  - **Comminuted**
    - When the bone is splintered or broken in many pieces that become embedded in the surrounding tissue
  - **Stress or hairline fracture**
    - A tiny crack in the bone that typically occurs from overuse
    - Can be quite painful but normally heals itself
- **Process of restoring bone occurs through three main methods:**
  - **Closed reduction**

        - The fragments are brought together into alignment by manipulation, and a cast/splint is applied to the area.
    - **Open reduction**
        - Devices such as wires, metal plates, or screws are used to hold the bones in alignment. (through surgical intervention)
        - Splint or cast can be applied
    - **Traction**
        - Pulling force that is used to hold the bones in place
        - Used for the fractures of the long bone
- **Diseases of the bones**
    - **Arthritis**
        - One of the most common health problems in the world
        - An inflammation of one or more joints, accompanied by pain, stiffness, swelling, and many other problems that affect the way that we complete everyday tasks.
    - **Rheumatoid Arthritis**
        - A chronic, autoimmune disease that affects the connective tissue and joints.
        - Thickening of the synovial membrane, joints are badly swollen.
    - **Osteoarthritis**
        - Degenerative joint disease
        - Occurs with aging
        - Articular cartilage degenerates and a bony spur formation occurs at the joint.
        - Joints may enlarge and there is pain and swelling
    - **Gout**
        - Characterized by an acute inflammation.
        - Pain and swelling is the body's response to the accumulation of uric acid crystals in the affected joint
    - **Kyphosis**
        - A humped curvature in the thoracic area of the spine

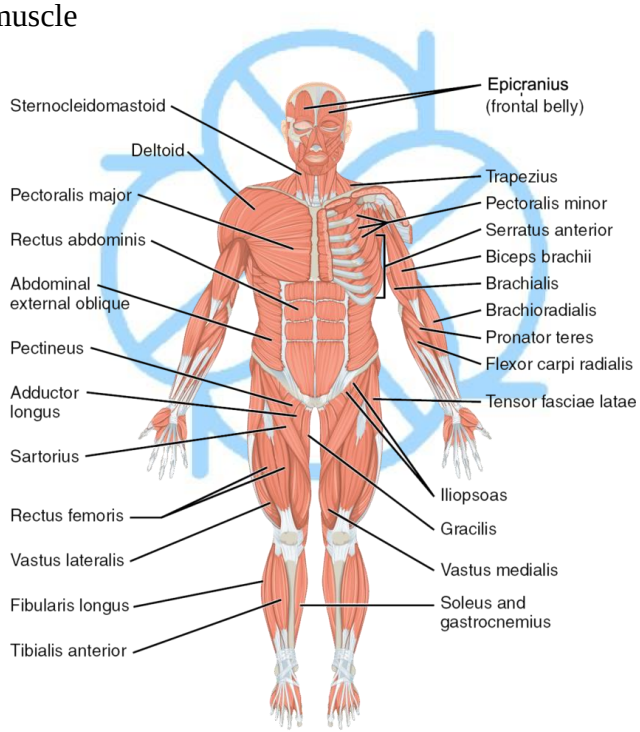
- **Lordosis**
  - Exaggerated inward curvature in the lumbar region of the spine
- **Scoliosis**
  - A side-to-side or lateral curvature of the spine
- **Osteoporosis**
  - Characterized by low bone mass and structural deterioration of the bone tissue
- **Osteomyelitis**
  - Infection that may involve all parts of the bone
  - Result from injury or systemic infection
  - Common in children between ages of 5-14
- **Osteosarcoma**
  - Bone cancer
  - Affects the long bone of a limb
- **Rickets**
  - Caused by the lack of vitamin d
  - Normally found in children



Muscular system

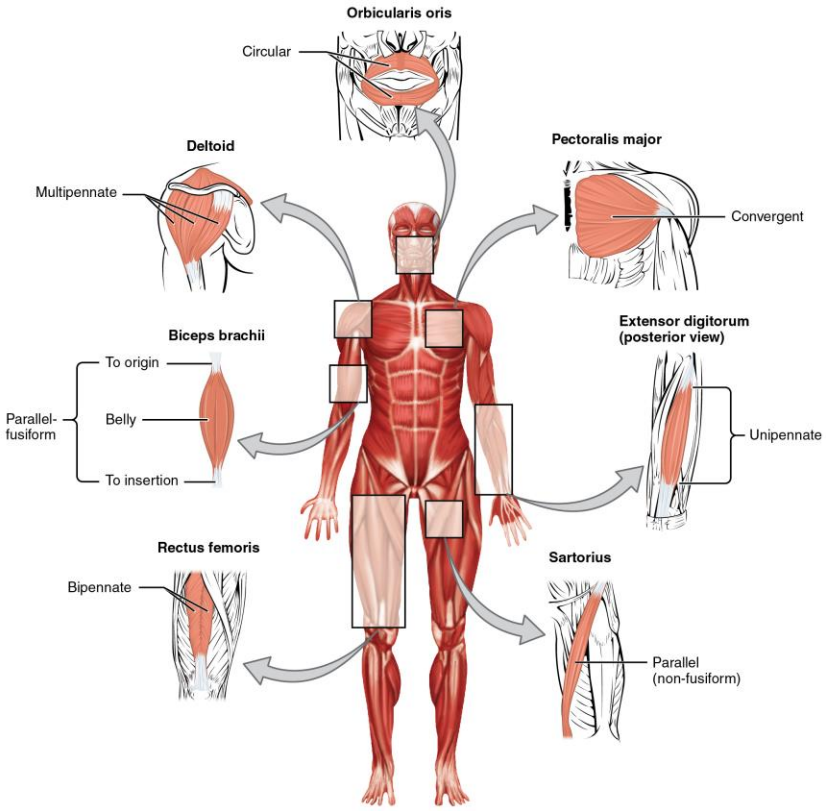
- **Functions**
  - Body movement
  - Body form and shape, to maintain
  - Body heat, to maintain body temperature
- **Types of muscles**
  - **Skeletal muscles**
    - Attached to the bones of the skeleton
    - Called striped or **striated**
      - Under a microscope they show crossbandings of altering light and dark bands running perpendicular to the length of the muscle.
    - Voluntary
  - **Smooth muscle**
    - Visceral muscle
    - Cells are small and spindle shaped
    - One nucleus, located in center of the cell
    - Unmarked
    - Unattached to bones
    - involuntary
  - **Cardiac muscle**
    - Only found in the heart
    - Striated and branched
    - Involuntary
  - **Sphincter muscles**
    - Special circular muscles in the openings between the esophagus and stomach, small intestine, anus, urethra, and the mouth.
- **Musculoskeletal disorders**
  - **Strain**
    - Overstretching or tearing of a muscle
    - From lifting too much weight, lifting improperly, or using their muscles excessively.

- **Spasm**
  - Cramp or contractions of the muscle
- **Myalgia**
  - Muscle pain
- **Dystonia**
  - Condition characterized by involuntary muscle contractions that cause repetitive movements.
- **Hernia**
  - Organs protrude through a weak muscle
- **Tetanus**
  - Infectious disease characterized by continuous spasms of the voluntary muscle



Major muscles of the body. Right side: superficial; left side: deep (anterior view)

(Wendy. (n.d.). Human Anatomy and Physiology Lab (BSB 141). Retrieved July 19, 2020, from https://courses.lumenlearn ing.com/ap1x94x1/chapter/the-muscles-of-the-trunk/)



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Endocrine System

- **Negative feedback**
  - When there is a drop in the blood level of a specific hormone, the drop triggers a chain reaction of responses to increase the amount of hormone in the blood
  - Acts like an air conditioner unit
    - There is a set temperature and when it gets out of range it kicks on
  - **Steps**
    - The level of **thyroxine** falls
    - The hypothalamus receives the message
    - Hypothalamus responds by releasing hormone for TSH
    - It goes to the anterior pituitary which responds by releasing TSH
    - TSH stimulates the thyroid gland to produce thyroxine
    - The thyroxine level rises, which causes the hypothalamus to shut off the releasing of TSH
- **Pituitary gland**
  - Tiny structure about the size of a grape
  - Located at the base of the brain
  - Hormones of the pituitary gland
    - Divided into 2 lobes
    - The larger (anterior) produces 6 hormones
    - Smaller (posterior) consists primarily of nerve fibers and neuroglial cells that support the nerve fibers
- **Anterior pituitary lobe**
  - **GH (somatotropin)**
    - Responsible for growth and development.
    - It helps fat to be used for energy
    - Saves glucose and maintains blood sugar
  - **PR (prolactin hormone)**
    - Develops breast tissue and stimulates the production of milk after child birth.
    - Function in males is unknown

    - **TSH (Thyroid stimulating hormone)**
        - Stimulates the growth and secretion of the thyroid gland
    - **ACTH (adrenocorticotropic hormone)**
        - Stimulates the growth and secretion of the adrenal cortex
    - **FSH (follicle stimulating hormone)**
        - Stimulates the growth of the graafian follicle and the production of estrogen in females, and stimulates the production of sperm in males
    - **LH (luteinizing hormone)**
        - Stimulates the growth of the graafian follicle, the production of the estrogen
- **Intermediate pituitary lobe**
    - Stimulates the melanin cells
- **Posterior Pituitary lobe**
    - **Vasopressin**
        - Converts to ADH in the bloodstream
    - **Oxytocin**
        - Released during childbirth, causes some contractions of the uterus
- **Pancreas**
    - Located behind the stomach
    - Acts as both an exocrine and endocrine gland
- **Insulin**
    - The B cells in the islets of langerhans produce this
    - Promotes the transmission of glucose in the blood
    - Necessary for maintaining normal levels
- **Pineal gland**
    - Small pinecone shaped organ attached to the roof of the 3rd ventricle in the brain
    - The hormone melatonin is produced here
- **Disorders of the endocrine system**
    - **Gigantism**
        - Overgrowth of the long bones leading to excessive tallness
    - **Acromegaly**

        - Overdevelopment of the bones of the face, hands, and feet
    - **Diabetes insipidus**
        - Drop in the amount of ADH
        - Causes excessive loss of water and electrolytes
        - Causes excessive thirst (polydipsia)
    - **Hyperthyroidism**
        - Overactivity of the thyroid gland
        - Caused by toxic nodules or medication
        - Enlargement of the eyes (goiter)
        - Bulging of the eyeballs (exophthalmos)
    - **Hypothyroidism**
        - The thyroid gland does not secrete a sufficient amount of thyroxine
            - Manifested by low T3 or T4 levels
        - May occur due to iodine deficiency
        - Enlargement of the thyroid gland
        - **Myxedema**
            - Face becomes swollen, weight increases, and memory fails
        - **Cretinism**
            - Lack of mental and physical growth
            - Results in mental retardation and malformation
            - Do not live past 7-8 years
        - **Thyroid cancer**
            - Most common of the endocrine system
            - Affects women more than men
            - Survival rates are 90%-100%, if caught early
        - **Tetany**
            - Extremely low calcium levels
            - Convulsive twitching, dies of spasms in the respiratory muscles.
        - **Pheochromocytoma**
            - Tumor in the adrenal gland
            - Causes excessive secretion of epinephrine

        - Is not cancerous, can be removed
        - Can be fatal
- **Cushing's syndrome**
    - Caused from the hypersecretion of glucocorticoid hormones from the adrenal cortex
    - More men than women suffer from this
    - Hypertension, weakness, obesity, skin lesions, etc.
- **Addson’s disease**
    - Hypofunctioning of the adrenal cortex
    - Bronzing of the skin, decreased levels of glucose, hypotension, etc.
- **Diabetes mellitus**
    - Decreased secretion of insulin from the islets of langerhans
    - **Type 1**
        - Juvenile diabetes
        - Usually in children and young adults
        - Caused from an autoimmune reaction
        - Must take insulin and monitor blood sugar
        - Polyuria (excessive urination), polydipsia, polyphagia (excessive hunger), blurred vision, etc.
    - **Type 2**
        - Common in adults over 45
        - Illness and tiredness, unusual thirst, frequent urination at night
        - Makes up of 90-95% of diabetics
        - Known cause is obesity

Blood

- **Composition**
    - **Plasma**
        - The liquid portion of blood without its cellular elements
    - **Erythrocytes**
        - Red blood cells
    - **Leukocytes**
        - White blood cells
    - **Thrombocytes**
        - Platelets
- **Blood plasma**
    - Straw-colored, complex liquid, 55% of the blood volume, and contains 6 substances:
    - **Water**
        - Makes up about 92% of the total amount of plasma
        - The percentage is maintained by the kidneys and by water intake/ output
    - **Plasma proteins**
        - Consists of three proteins:
            - **Fibrinogen**
                - Necessary for blood clotting
                - Synthesized in the liver
                - Without it, you would bleed continuously
            - **Albumin**
                - Most abundant of the plasma proteins
                - Another product of the liver
                - Maintains the blood's osmotic pressure and volume
                - Holds and pulls water from the tissue into the blood vessels
            - **Globulin**
                - Formed in the lymphatic system and the liver
                - Helps in the synthesis of antibodies

        - Destroy harmless various disease-causing organisms
    - **Hematopoiesis**
        - The formation of blood cells
        - Occurs in the red bone marrow
        - All blood cells develop from undifferentiated mesenchymal cells
            - Known as stem cells or hemocytoblasts
- **Erythrocytes**
    - **Erythropoiesis**
        - Manufacture of red blood cells
        - Occurs in the red bone marrow in all bones
            - Happens until adolescence
        - Red bone marrow is replaced with fat marrow as we grow older
    - **Hemoglobin**
        - A red pigment that gives cells their color
        - Made of a protein molecule called globin and an iron compound called heme
        - One blood cell contains several million molecules
        - Vital to the function of red blood cells
            - Allows them to transport oxygen to the tissues and carbon dioxide away from the tissues
        - Normal amount of hemoglobin for men is 14-18g
        - Normal amount of hemoglobin for women is 12-16g per 100ml
    - **CO poisoning**
        - Serious and fatal condition
        - Carbon monoxide rapidly combines with hemoglobin molecules such as oxygen, crowding the oxygen out
        - The cells become deprived of oxygen
        - Symptoms include and are limited to:
            - Headache, dizziness, drowsiness, and unconscious
            - Death only occurs in severe cases

- **Hemolysis**
  - The rupture of a red blood cell
  - Occurs as a result of a blood transfusion reaction

- **Leukocytes**
  - **White blood cells (leukocytes)**
    - Have nuclei and no pigment whatsoever
    - They are larger than erythrocytes and granular (grainy appearance)
    - Manufactured in both red bone marrow and in the lymphatic system
    - Body's natural defense against injury, disease, infection, etc.
  - **Types of leukocytes**
    - Identified into 2 main groups: granulocytes and agranulocytes
      - **Granulocytes** are made in red bone marrow from cells called myeloblasts
        - Destroyed as they age
        - Only live a few days
        - There are three types of granulocytes
          - **Neutrophils**
            - Known as **polymorphonuclear leukocytes**
            - Phagocytize bacteria with lysosomal enzymes
              - Phagocytosis is a process that surrounds, engulfs, and digests harmful bacteria
          - **Eosinophils**
            - Phagocytize the remains of antibody-antigen reactions
            - Increase in number in allergic reactions, malaria, or worm infestations
          - **Basophils**
            - Activated during an allergic reaction
            - Produce histamine and heparin

- **Inflammation**

    - Occurs when tissues are subjected to chemical or physical **trauma** or **invasion** by pathogenic microorganisms
    - **Characteristic symptoms** include redness, local heat, swelling, and pain
    - Due to irritation by bacterial toxins, to increased blood flow, to congestion of blood vessels, and to the collection of blood plasma in the surrounding tissues
    - **Histamine** released from the basophil and other chemical substances increases blood flow to the injured area
    - Large amounts of blood plasma and fibrinogen enter the damaged area
        - Damaged area becomes walled off from the clotting action of fibrinogen
        - Neutrophils move very quickly to the damaged area
            - Neutrophils move through the capillary walls by diapedesis and begin phagocytosis of the pathogens
    - Pus forms
- **Homeostasis**
    - Refers to stopping the bleeding
    - Can be accomplished by **vasoconstriction**
- **Blood clotting (Coagulation)**
    - When a blood vessel or tissue is injured, platelets and injured tissue release **thromboplastin**
    - Blood platelets flow over the injured area
    - Then, they disintegrate, releasing thromboplastin
    - The thromboplastin and calcium ions act as enzymes in a reaction that converts **prothrombin** into **thrombin**
        - The thrombin changes the fibrinogen into **fibrin** and the threads layer themselves over the cut
    - **Serum** oozes out of the cut
        - The serum slowly dries forming a scab
- **4 types of blood**
    - **A+/-**
        - A+ can receive the blood types A+/-, O+/-
        - A- can receive the blood types A-, O-

- **B+/-**
  - B+ can receive B+/-, O+/-
  - B- can receive B-, O-
- **AB+/-**
  - AB+ is a **universal recipient**
  - AB+ can receive AB+/-, A+/-, B+/-, O+/-
  - AB- can receive AB-, A-, B-, O-
- **O+/-**
  - O- is a **universal donor**
  - O+ can receive O+, O-
  - O- can receive O-

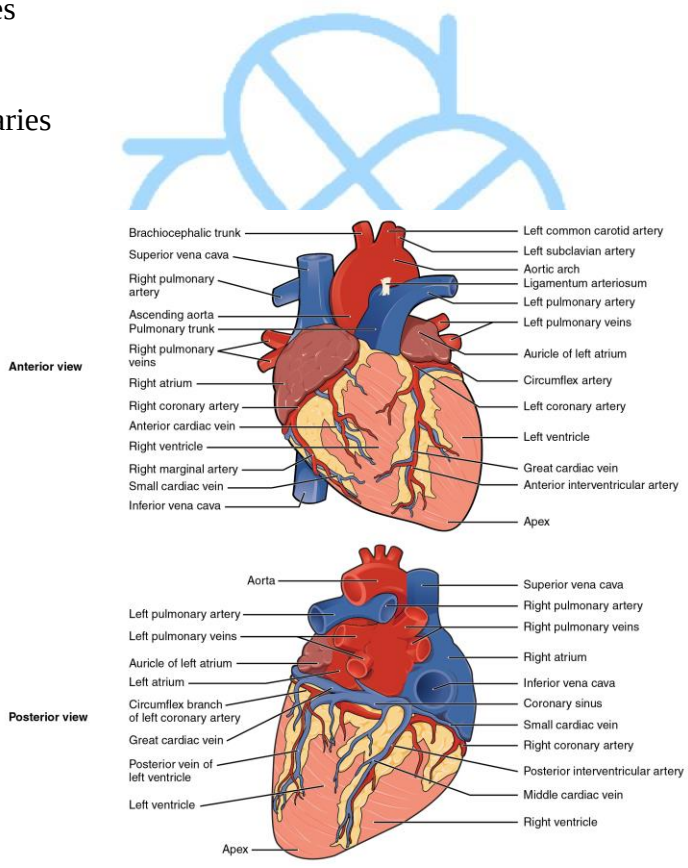
- **RH Factor**
  - Found on the surface of the red blood cells
  - People who possess it are RH+
  - People who don't possess it are RH-
- **Hematocrit**
  - Blood test that measures the percentage of volume of whole blood that is made up of red blood cells
  - The measurement depends on the number of red blood cells and their size
  - Normal Hct in males is 47%
  - Normal Hct in females is 42%
- **Blood disorders**
  - **Anemia**
    - Deficiency in the number or percentage of red blood cells and the amount of hemoglobin in the blood
    - Results in a large loss of blood
    - 400 types of anemia
    - Never enough oxygen transported in the cells
    - Symptoms include and are limited to dyspnea, pallor, palpitation, and fatigue
  - **Iron deficiency anemia**

        - Exists in women, children, and adolescents
        - Caused by a deficiency of adequate amounts of iron
        - Leads to an insufficient hemoglobin synthesis
    - **Pernicious anemia**
        - Form of anemia caused by the deficiency of vitamin B12
    - **Aplastic anemia**
        - A disease caused by the suppression of the bone marrow
        - There are idiopathic causes and secondary
    - **Sickle cell anemia**
        - Chronic blood disease that is inherited from both parents
        - Red blood cells form in a abnormal crescent shape
        - Cells carry less oxygen and are easily breakable
        - Most prevalent in African Americans
    - **Thalassemia**
        - Inherited blood disorder that causes severe to mild anemia
    - **Colley's anemia**
        - Defect in hemoglobin
        - Affects people of the Mediterranean descent
        - Iron overload
    - **Polycythemia**
        - Too many red blood cells are formed
        - Can be temporary at high altitudes
        - Thickening of the blood
            - Makes clot formation possible
        - Treatment includes removal of 1 pint of blood and a low dose of aspirin
    - **Embolism**
        - Embolus is carried into the bloodstream until it reaches an artery too small for passage
        - May include air, blood clot, cancer cells, fat, bacterium, etc
    - **Thrombosis**
        - The formation of a blood clot in a blood vessel

- **Thrombus**
  - The blood clot formed
  - Caused by low blood circulation
- **Hematoma**
  - Localized clotted mass of blood found in an organ
  - Caused by traumatic injury
- **Hemophilia**
  - Blood clots slowly or abnormally
- **Leukemia**
  - Cancerous or malignant
  - Number of white blood cells is greatly increased
  - Interferes with the transportation of oxygen
  - Hinders the formation of new red blood cells
- **Multiple myeloma**
  - Malignant neoplasm
  - Cells multiply abnormally in the bone marrow
- **Septicemia**
  - Presence of pathogenic organisms in the blood

Heart

- **Functions**
  - Pumps the blood to all parts of the body
  - Arteries, veins, and capillaries are the structures that take blood from the heart to the cells and return blood from the cells back to the heart
  - Blood carries oxygen and nutrients to the cells and carries the waste products away
  - The lymph system returns excess fluid from the tissues to the general circulation and is part of the cardiovascular system
- **Organs of the circulatory system**
  - Heart
  - Arteries
  - Veins
  - Capillaries
  - Blood



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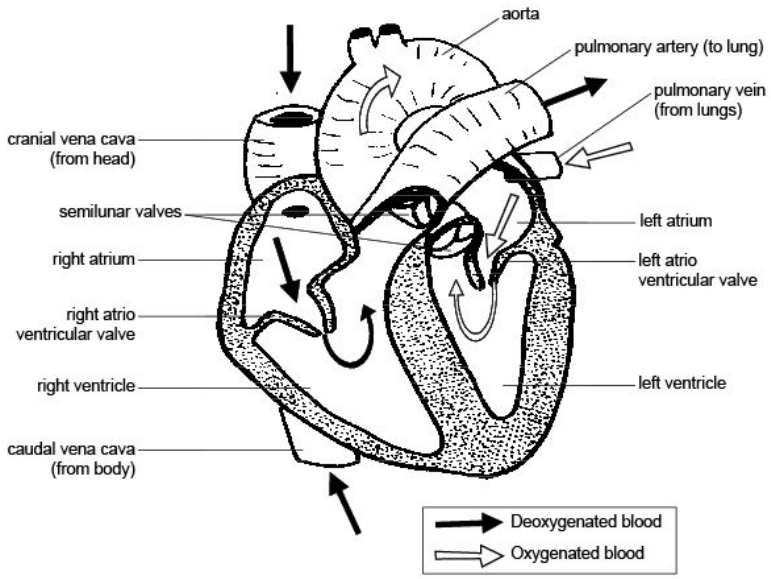

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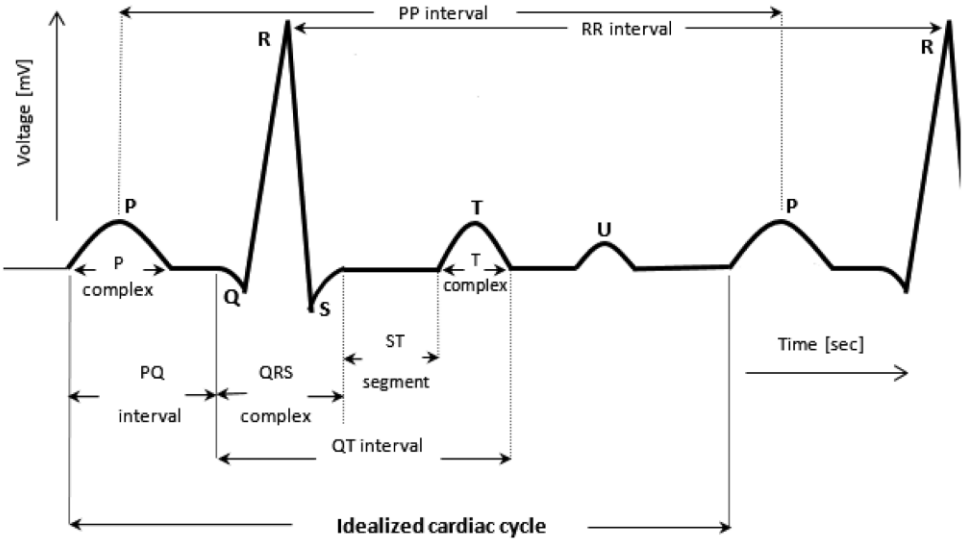

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Heart continued…

- **Diseases of the heart**

- **Arrhythmia**
  - Change or deviation from the normal rate or rhythm of the heart
- **Bradycardia**
  - Slow heart rate
    - Less than 60 beats per minute
- **Tachycardia**
  - Rapid heart rate
    - More than 100 beats per minute
- **Murmurs**
  - When valves fail to close, a gurgling sound will occur
  - If it occurs while the heart is contracting its called systolic
  - If it occurs while the heart is resting its called diastolic
- **Mitral valve prolapse**
  - Condition in which the valve between the left atrium and the left ventricle closes imperfectly
- **CAD (Coronary Artery Disease)**
  - Narrowing of the coronary arteries that supply oxygen and nutrient-filled blood to the heart muscle
- **Angina pectoris**
  - The severe chest pain that arises when the heart does not receive enough oxygen
  - Symptom of underlying problem with coronary circulation
- **Myocardial Infarction**
  - "Heart attack"
  - Caused by a lack of blood supply to the myocardium
- **Pericarditis**
  - Inflammation of the outer membrane covering the heart
- **Myocarditis**
  - Inflammation of the heart muscle
- **Endocarditis**
  - Inflammation of the membrane that lines the heart and covers the valves

    - **Heart failure**
        - When the ventricles of the heart are unable to contract effectively and blood pools in the heart
    - **Congestive heart failure**
        - In left sided failure, fluid accumulates in the lungs, backing blood up into the lung vessels
        - In right sided failure, fluid builds up throughout the body
- **Types of heart surgery**
    - **Angioplasty**
        - Balloon surgery
        - A small deflated balloon is threaded into the coronary artery
        - When it reaches the blocked area, the balloon is then opened and closed a few times, until the blockage is pushed against the arterial wall until the area is unblocked
        - The balloon is then deflated and removed
    - **Cardiac stents**
        - Stainless steel devices that hold arteries open after an angioplasty
    - **Coronary bypass**
        - Surgically providing a detour to allow the blood supply to go around the blocked area of a coronary artery
    - **TMR (transmyocardial laser revascularization)**
        - The use of lasers to puncture holes in the heart muscle to improve blood flow

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